

Appln. No. 10/776,715  
Response dated September 11, 2007  
Reply to Office Action of June 11, 2007

#### REMARKS/ARGUMENTS

Reconsideration of the present application, as amended, is respectfully requested.

The June 11, 2007 Office Action and the Examiner's comments have been carefully considered. In response, claims are cancelled and amended, and remarks are set forth below in a sincere effort to place the present application in form for allowance. The amendments are supported by the application as originally filed. Therefore, no new matter is added.

#### PRIOR ART REJECTIONS

In the Office Action claims 1-3, 5-27 and 29-48 are rejected under 35 USC 102(e) as being anticipated by USP 6,397,307 (Ohran). Claims 4 and 28 are rejected under 35 USC 103(a) as being unpatentable over Ohran in view of U.S. Patent Publication No. 2002/0156971 (Jones). In response, claims are cancelled and amended, and remarks are set forth below in a sincere effort to point out patentable features of the present invention and to place the application in condition for allowance.

It is respectfully submitted that a patentable difference between the present claimed invention and Ohran is the teaching in Ohran of the "logically consistent state." As explained in

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Ohran in the paragraphs cited hereinbelow, Ohran is unable to backup at any desired moment, but is instead compelled to wait for the primary storage system to reach a logically consistent state before backup occurs. Although this limitation is presented as an advantage in Ohran, this feature is instead a substantial drawback. Ohran's system is unable to function unless being backed-up at the system's convenience. That is, when the primary storage system has reached a logically consistent state. This means that the system of Ohran is capable of backup only at discrete instants without having any control over or advance knowledge as to when these discrete instants will occur. This is in contrast with the present claimed invention as defined by amended claims 1 and 25, which operates at any desired instant in time (see claim 1, lines 15-16 and claim 25, lines 18-19).

Ohran recites at column 4, line 57 to column 5, line 3:

The foregoing problems in the prior state of the art have been successfully overcome by the present invention, which is directed to a system and method for mirroring and archiving a primary mass storage system to a secondary mass storage system. The current system and method provides several significant advantages over the prior art. First, the mirroring and archiving system and method of the present invention reduces the amount of data needed to mirror and archive by consolidating redundant changes and then transferring only those consolidated changes. Second, the system and method of the present invention emphasize security of the mirroring and archiving by ensuring that the primary storage system is in a logically consistent state when an update is made.

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This means that to archive, Ohran is compelled to wait and update only when the primary storage system reaches a logically consistent state.

Ohran further recites at column 5, lines 39 to 52:

The present invention includes a mechanism to identify when the primary mass storage system is in a logically consistent state in order to determine when an update should be created. By identifying a logically consistent state and then creating an update of the changes made up to that point in time, the updates transferred to the secondary system are guaranteed to capture a logically consistent state. By creating updates of succeeding logically consistent states, the secondary system can archive one logically consistent state after another. In this way, if the archived data should ever be needed, it will be in a logically consistent state. The data stored at the secondary system moves from one logically consistent state to another logically consistent state thus eliminating one of the problems of the prior art.

Ohran needs a mechanism to identify "when the primary mass storage system is in a logically consistent state," or else the system will not operate, which is not the case with the present claimed invention which operates at any desired instant in time.

Ohran then recites a self-evident truth: "By identifying a logically consistent state and then creating an update of the changes made up to that point in time, the updates transferred to the secondary system are guaranteed to capture a logically consistent state." This means that an update made at a logically consistent state provides an update residing in a logically consistent state.

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The limitation of having to wait for the system to reach a logically consistent state is not required, which is a great advantage of the present claimed invention.

In addition to the "logically consistent state" condition, Ohran recites one more condition regarding operation on synchronized data, as disclosed at column 6, lines 17 to 35:

The secondary system of the present invention receives each update from the primary system. The update serves to bring the secondary mass storage system current with the primary mass storage system. In addition to this mirroring function, the updates also provide archiving. By retaining updates rather than integrating them with the synchronized data, the secondary system can deliver any of the logically consistent states that the updates represent. For example, if a problem occurs prior to a fourth update, the secondary system can combine the synchronized data with the first three updates. This combination represents the logically consistent state of the primary mass storage system as it existed at the time of the third update. Thus, the secondary system can provide any of a potentially large number of logically consistent states of the primary mass storage system. As the archival value of a given update diminishes over time, it can eventually be integrated with the synchronized data or collapsed with other updates, thereby limiting the number of updates stored at the secondary mass storage and the required size of the secondary mass storage.

Ohran emphasizes the limitation related to "logically consistent states" and recites operation on synchronized data, in contrast with the present claimed invention, which is applicable for asynchronously mirroring data.

To emphasize the inability to handle logically inconsistent states, Ohran further recites at column 6, lines 40 to 44:

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Another central object of the present invention is to provide a system and method for mass storage mirroring and archiving that can capture logically consistent states so that the secondary system is not found in a logically inconsistent state.

As indicated above, this limitation to updating only when the system reaches a logically consistent state is not a factor in the present claimed invention which updates at any desired instant in time.

At column 8, lines 46-60, Ohran reiterates the need for both consistent and synchronized data:

The tracking of changes and creation of updates preferably occur when the primary mass storage contains consistent data. Otherwise, the data stored in the secondary system is of somewhat less worth. Combining the initially synchronized secondary mass storage with the updates, including the most recent update, yields the most recent consistent state of the primary mass storage. However, the secondary mass storage keeps the updates and the initial synchronized data separate. This separate storage allows for a combination of the synchronized data with something short of the most recent updates to provide a history of each mirrored consistent state of the primary mass storage. The foregoing processes represent data archiving, which generates a historical record of the data as it was stored at the primary system at some previous moment.

Again, the present claimed invention does not require consistent and synchronized data.

The prerequisite for operation in a logically consistent state is further recited by Ohran in the following paragraphs, inter alia: Column 12, lines 11-23, column 12, lines 49-61,

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column 14, lines 9-30, column 15, lines 36-50, column 16, lines 36-54, and column 17, lines 24-59.

The limitations recited in Ohran are necessary for known backup systems, for example, when there is a need to restore data. Should inconsistent files reside in the backup, then, at the time restoration is requested, those inconsistent files will corrupt the current files residing in the primary system. This may happen even if the files in the primary system reside in a logical consistent version.

With an asynchronous mirroring functionality such as that of the present claimed invention, the mirrored data at the remote site are allowed to contain logical inconsistencies, which is different from that of Ohran. With the present claimed invention there is no need for logical consistency as a prerequisite for mirroring or for restoration since the recovery is achieved by simply mounting the file system of the remote mirroring functionality.

Should logical inconsistencies be present at recovery time, these inconsistencies will be treated at the time when the files system is mounted in the same manner as a file system recovery process would treat a sudden lack of power when in the midst of operations.

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Since no logical state conditions are required with the present claimed invention, the frequency of mirroring replication is defined as desired, and thus at an increased frequency when compared to Ohran.

A logical consistent condition is achieved by requiring, and then by waiting until the file system stops all the I/O and writes operations of its cached data into storage, which may take a few seconds. While in past years it was perhaps reasonable to wait for a logical consistent condition and to mirror every few hours, it is obvious that nowadays, stopping for a few seconds say every minute or so, is no longer acceptable. Due to the fact that the present claimed invention does not require stopping or waiting for logical consistent conditions, asynchronous functionality mirroring operations are as frequent as desired, such as even less than every minute, or every minute, or every few minutes. Thereby, the amount of lost data may be minimal when a breakdown occurs, and a much more granular recovery may be achieved. Even if taken alone, the ability to take snapshots for update when desired presents an enhancement of orders of magnitude when compared to Ohran.

It is respectfully maintained that Ohran requires consistent data and synchronized data to operate, whereas the present

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claimed invention does not require such restrictions, but instead operates at any desired instant in time.

Another difference between Ohran and the present claimed invention is a further condition disclosed at column 5, lines 4 to 23 of Ohran:

The present invention begins with the assumption that a primary mass storage system connected to a primary system and a secondary mass storage system connected to a secondary system contain identical data. This may be accomplished, for example, by making a complete copy of the primary mass storage system to the secondary mass storage system using either traditional backup techniques or traditional disk mirroring techniques. Once the primary mass storage system and the secondary mass storage system contain the same data, the present invention tracks the changes made to the primary mass storage system. This tracking is done by identifying new data written to storage locations in the primary mass storage system after the time that the secondary mass storage system was in sync with the primary mass storage system. By identifying those changes that have been made to the primary mass storage system, the invention identifies those changes that need to be stored at the secondary mass storage system in order to bring the secondary mass storage system current with the primary mass storage system.

Ohran prerequisites the condition, which is referred to as an "assumption," that "a primary mass storage system connected to a primary system and a secondary mass storage system connected to a secondary system contain identical data." Such a condition is not required with the present claimed invention, which is thus different from Ohran.



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It is respectfully noted that the foregoing arguments presented in relation with method claim 1 are also applicable to system claim 25.

In view of the foregoing, reconsideration and withdrawal of the rejection of claims 1 and 25 are respectfully requested. In addition, allowance of claims 2, 3, and 5-24 which are dependent on claim 1, and claims 26, 27, and 29-48, which are dependent on claim 25, is respectfully requested.

\* \* \* \* \*

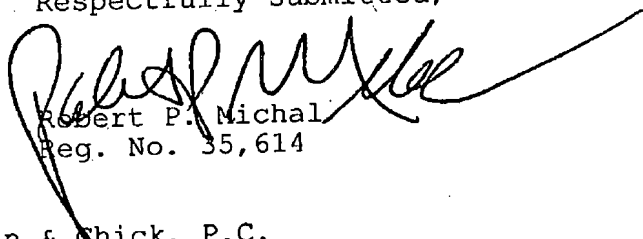
Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner disagrees with any of the foregoing, the Examiner is respectfully requested to point out where there is support for a contrary view.

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If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,



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